
Texas Instruments
Microsoft
ADVANCING THE PLATFORM
WinHEC
WinHEC 99
Windows® Hardware Engineering Conference

Future PC System Architecture - Internal

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AMD

Agenda: Generations of the PC Architecture

- 6th Generation
  - Instruction set modernization
  - Enhancement of legacy
- 7th Generation
  - Revolution in data movement
  - µArchitecture to utilize instruction set
  - Completes migration of server & workstation features to mainstream PCs

Instruction Set Modernization

- Multimedia Content Provided Motivation
  - SIMD provides performance opportunity
  - Brings vector processing to the desktop
- MMX™ Instructions Opened the Door
- 3DNow!™ Technology solves the Real Problem
  - Geometry, audio, physics
- Enhanced MMX For Video Helps Integer
- Microsoft will Support these Technologies in Future Releases of Visual Studio

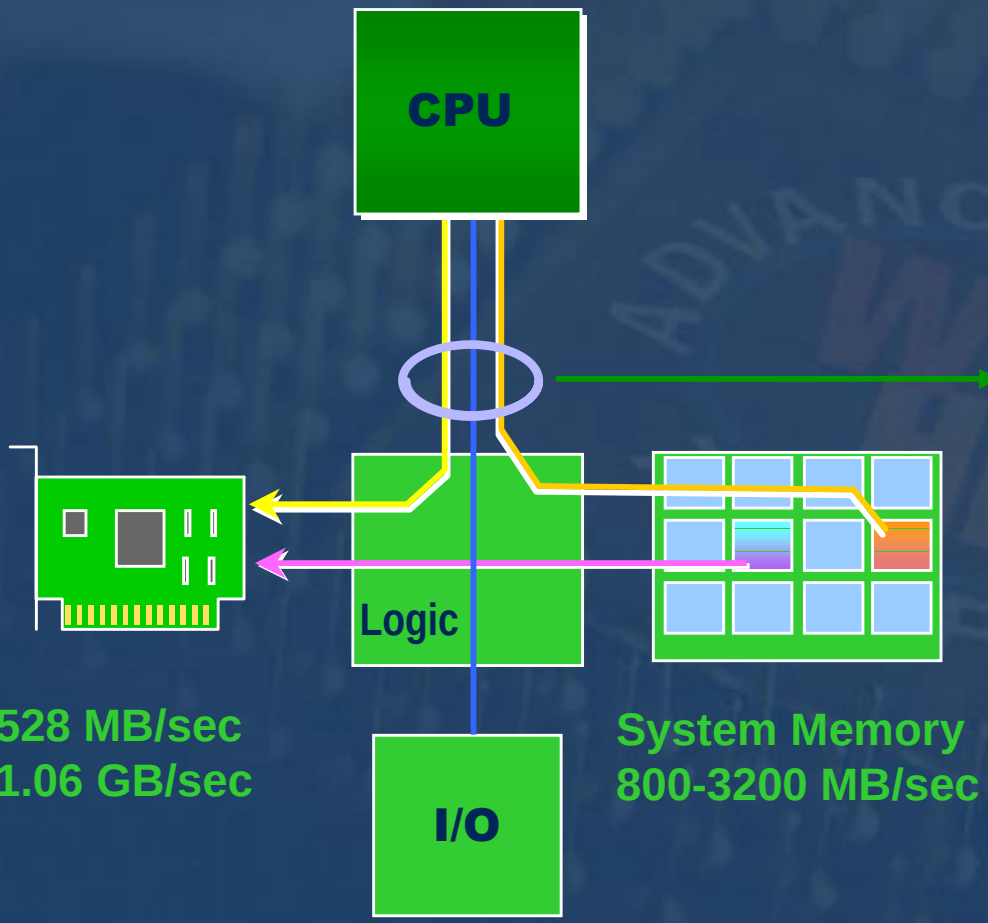
6th Generation: Extensions of Legacy Architecture

- Socket 7 Evolved to:
  - Super7™ (100MHz, AGP2X)
  - Slot 1 (100MHz, AGP2X, partial split transaction)
  - Camino (133MHz, AGP4X)
- Caches Evolved: Large L1, Back side L2:
  - AMD-K6®-III: 32KB/32KB/256KB (full speed)
  - Pentium® III: 16KB/16KB/512K (half speed)

The 7th Generation

Completion of Server & Workstation Migration to Mainstream PC

Data Bandwidth Deficit



AGP
2x = 528 MB/sec
4x = 1.06 GB/sec

System Memory
800-3200 MB/sec

PCI, PCI-64/66,
1394

Today's Simplified Maximum Bandwidth Requirements:

- Memory	(8 x 100) =	800 MB/s
- 2x AGP	(2 x 32 x 8) =	528 MB/s
- PCI	(4 x 32) =	133 MB/s
	Total =	1,461 MB/s

Tomorrow's Simplified Maximum Bandwidth Requirements:

- Memory	(2 x 800) =	1.6 GB/s
- 4x AGP	(4 x 8 x 33) =	1.1 GB/s
- I/O	(various) ~	.5 GB/s
	Total ~	3.2 GB/s

6th Generation Front side bus:
Today: 8 x 100 = 800 MB/sec
Q3'99: 8 x 133 = 1.06 GB/sec

The Data Problem

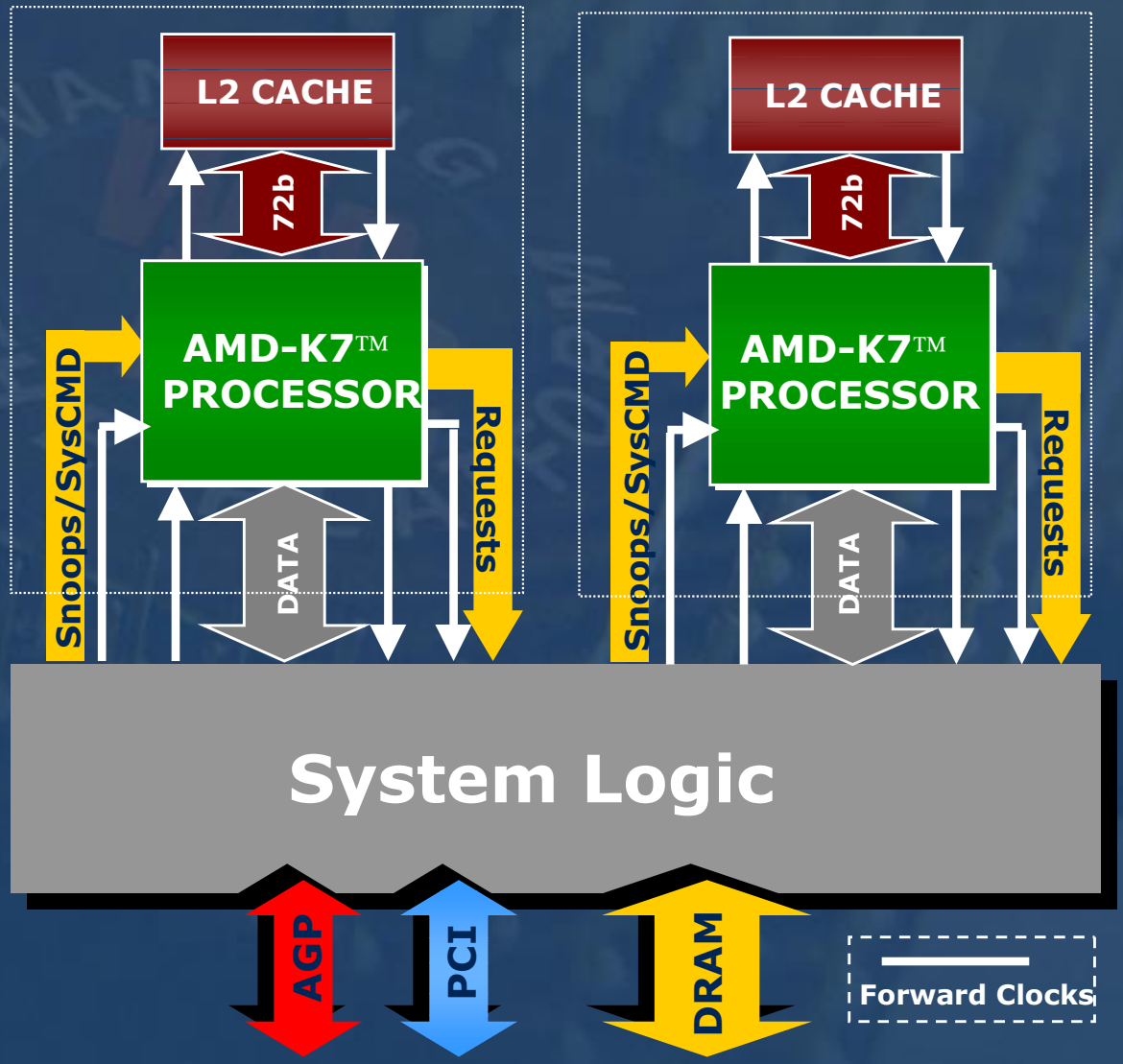
- Data Bottlenecks
  - Slow Legacy processor buses (.8 to 1.06 GB/s)
  - Shared buses for MP
  - Small (32 byte) cache blocks
  - Limited I/O bandwidth
- Technology Advances
  - 500MHz processors today; 1GHz in 2000
  - SIMD processes data faster
  - 1394, 4x AGP, etc.
  - Increasing snoop traffic

The Solution: A Revolution in Data Movement

- AMD-K7 Fully Programmable Back Side L2:
  - Scales beyond 8B*1GHz = 8 GB/s
- AMD-K7 Front Side Bus Options
  - 8B * 133 MHz = 1.1 GB/s
  - 8B * 200 MHz = 1.6 GB/s
  - 8B * 266 MHz = 2.1 GB/s
  - 8B * 400 MHz = 3.2 GB/s
- Memory Bandwidth
  - SDRAM: 8B * 100 MHz = 0.8 GB/s
    8B * 133 MHz = 1.06 GB/s
  - Rambus: 2B * 400 MHz * 2x = 1.6 GB/s

AMD-K7™ Front side Bus: EV6 in a PC

- 1.6GB/s that scales to 3.2GB/s per Processor
- Back Side L2 Cache
- Up to 24 Outstanding Transactions per Processor
- 13-Pin Address Bus
- 13-Pin Snoop Bus
- 72-Pin Data Bus w/ECC
- Scales to 43-bit Physical Address

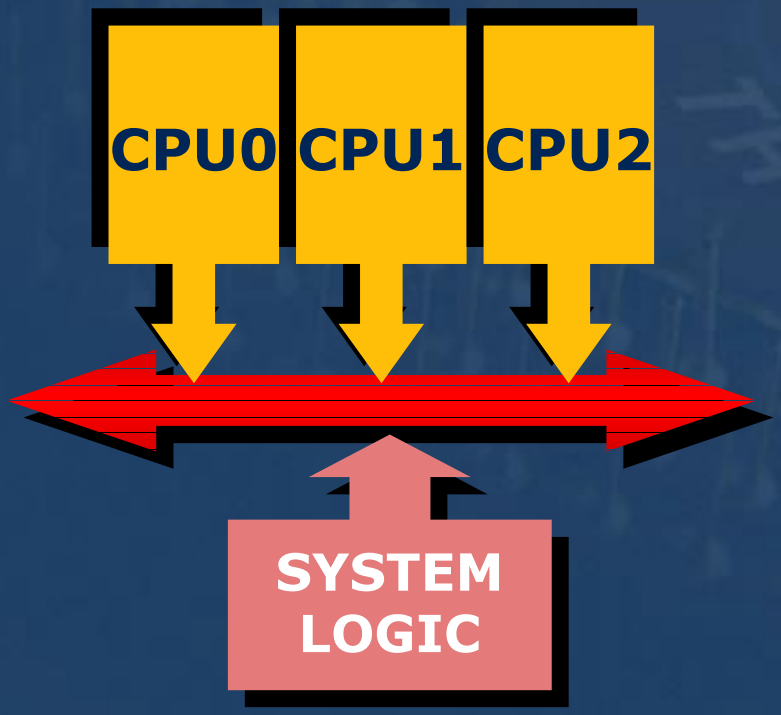


Server Level MP Support

- Separate Data, Address, and Snoop Paths
- Point-to-Point access to Data Bus in MP Configuration(s)
- True Split Transaction Bus
  - Up to 24 outstanding operations per AMD-K7 processor
- Scales to 8 Terabytes of Data Space

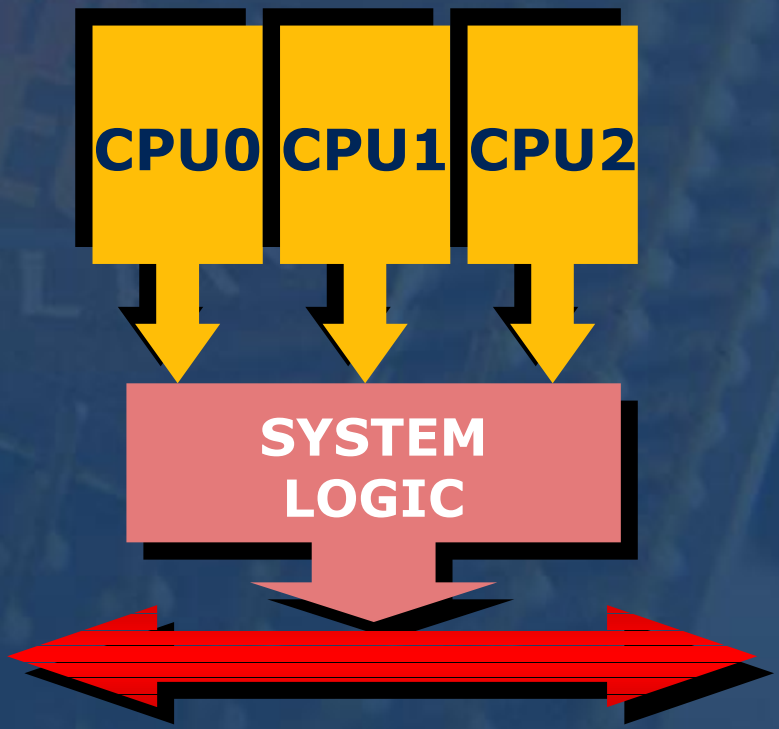
Bus Topology Comparison

- Shared bus limits frequency
- Available bandwidth is shared
- Snoops interferes with Xfrs



SHARED BUS

- PTP source synchronous bus
- Independent bus per CPU
- Separate path for snoop traffic



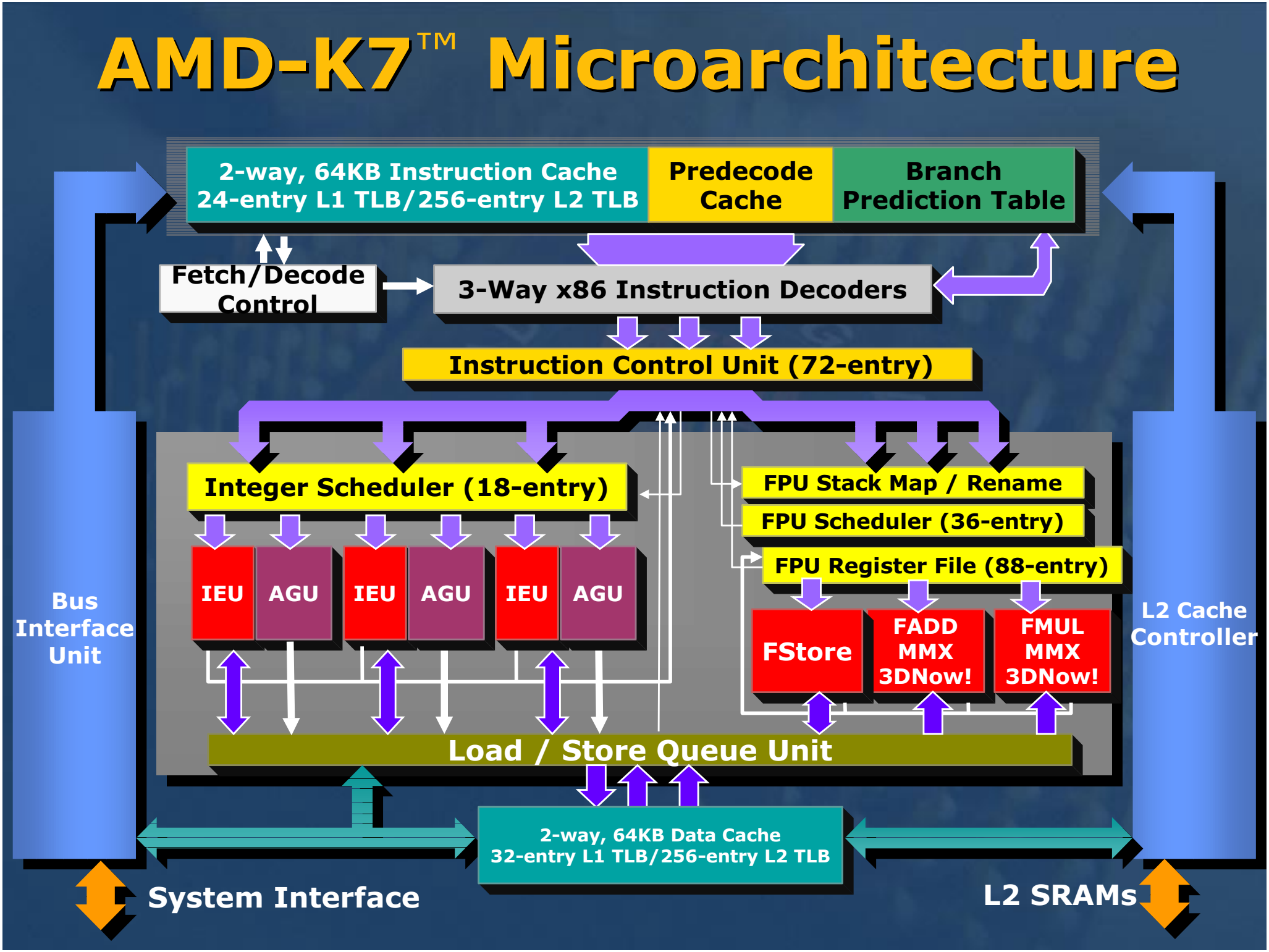
POINT-TO-POINT

Workstation Class Floating Point & Multimedia Performance

- 7th Generation Data Bandwidth Enables 7th Generation Execution Performance
- 9 Issue Total Execution Bandwidth
- 3 Issue Floating Point Unit
  - 2x increase in peak execution rate
  - Multiply, add, control/move/store ops
  - No switching overhead:

    3DNow!/MMX <> x87 code
- Deep Out Of Order Window
  - 36 Entry FPU scheduler
  - 72 Entry ROB

AMD-K7™ Microarchitecture



Summary

- The 7th Generation Revolution Begins this Summer
  - 1.6 GB/s data bus bandwidth
  - Performance jump in floating point
- And It Supports:
  - Doubling the bandwidth in the memory system
  - Huge increases in frequency
  - Further increases in the data bus bandwidth
  - Much greater I/O bandwidth that isn't bottlenecked on the system bus (4x AGP, 64/66 PCI)
  - AMD-K7™ Processor Enables the 7th Generation

AMD

Call to Action

- Platform Innovation Can Begin Now
  - Develop chipsets, graphics, and memory systems for the 7th Generation PC
  - Enhance I/O subsystems

Enables:

- ISV's to Develop the Next Generation of Killer Applications

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